

PROJECT facts

Sequestration

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U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY



ENHANCED COAL BED METHANE PRODUCTION AND SEQUESTRATION OF CO₂ IN UNMINEABLE COAL SEAMS

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Background

CONSOL Energy Inc. is demonstrating a novel drilling and production process that reduces potential methane emissions from coal mining, produces usable methane (natural gas), and creates a sequestration sink for carbon dioxide (CO₂) in unmineable coal seams. CONSOL's project employs horizontal drilling to drain coalbed methane (CBM) from a mineable coal seam and an underlying unmineable coal seam. Upon drainage of 50–60 percent of the coalbed methane, some of the wells will be used for CO₂ injection to sequester the CO₂ in the unmineable seam, while stimulating additional methane production. The technique starts with a vertical well drilled from the surface followed by a guided borehole that extends up to 3,000 feet horizontally in the coal seam, allowing for production over a large area from relatively few surface locations.

The project involves development of a 200 acre area involving two coal seams. The lower, unmineable seam will be degassed and eventually injected with CO₂. The upper, mineable seam will be degassed to produce coalbed methane, thus avoiding methane emissions when the seam is mined. The upper, mineable seam will be isolated from the lower, unmineable seam to prevent CO₂ migration from the unmineable seam into the mineable seam.



Picture of the North degassing wells



PARTNER

CONSOL Energy Inc.

COST

Total Project Value

\$13,216,903

DOE/Non-DOE Share

\$8,983,942 / \$4,232,961

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Primary Project Goal

To evaluate the effectiveness and economics of CO₂ sequestration in an unmineable coal seam.

Objectives

- Demonstrate the application of coal seam methane production technology using horizontal drilling to degasify an unmineable coal seam
- Use the sale of methane to reduce the cost of CO₂ sequestration
- Sequester carbon dioxide in a degassed, unmineable coal seam
- Demonstrate that the CO₂ remains sequestered in the coal seam in which it was injected

Accomplishments

- Wells were drilled at three sites, designated south, central, and north. The mineable seam is the Pittsburgh seam, and the unmineable seam is the Upper Freeport seam. Horizontal drilling is complete at the south and central well sites.
- South Well Site: At the south well site, the horizontal drilling of both the Pittsburgh seam and Upper Freeport seam is complete. The Pittsburgh seam horizontal legs were 3,000 ft; the upper Freeport seam horizontal legs were 2,500 and 1,500 ft, shorter than planned due to thinning of the coal seam. The CBM flow, from the Pittsburgh and Upper Freeport seams, is approximately 350-400 mcf/d and 35-50 mcf/d, respectively. Water pumping activities continue for the Pittsburgh seam; water production averages 350 barrels per day.
- Central Well Site: At the central well site, two wells each with two horizontal legs were drilled in the Upper Freeport seam and completed at 1,000 ft each, as planned. Piping was installed from the center wells to the amine plant at the south well site. The total CBM flow from the center wells is approximately 35-50 mcf/d.
- North Well Site: Two north site Pittsburgh seam wells were completed at 3,000 ft each, as planned, and one north site Upper Freeport seam well was completed at 2,200 ft, shorter than planned due to thinning of the coal seam. After completion, dewatering activities commenced but two of the wells suffered down-hole pumping problems. All three wells were reworked in an attempt to correct the pumping problem. The Upper Freeport seam well was abandoned due to collapse of the horizontal element and sump junction. The two Pittsburgh seam wells were reworked, but CBM gas flows have been limited to a few mcf/d. A decision on any future drilling or reworking of the wells at the north site is pending.
- An amine plant was installed at the south well site. The amine plant removes CO₂ from the CBM gas and also dries the CBM gas to pipeline quality. Methane gathering piping was installed from the center and south well sites to the amine plant. The amine plant output is 375-400 mcf/d; approximately 300 mcf/d is being delivered to the pipeline and the remaining gas is being used to power the gathering equipment.

Benefits

This project will provide a documented case study of the effectiveness and economics of carbon dioxide sequestration in an unmineable coal seam. The results can be used by mining and power generation companies who wish to sequester CO₂ in unmineable coal seams and by regulatory agencies and the public to aid in policy and permitting decisions.